

CLAIMS

1. A method, comprising a step of:

(a) determining at least one calculated parameter based upon at least one determined

5 performance parameter of the user and at least one determined variable physiological parameter of the user.

2. The method of claim 1, wherein the at least one determined performance

parameter of the user includes at least one determined foot contact time of the user, and the at

10 least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

3. The method of claim 2, wherein the at least one calculated parameter is

proportional to the at least one determined foot contact time of the user multiplied by the at least 15 one determined heart rate of the user.

4. The method of claim 2, wherein the step (a) includes including the at least one

determined performance parameter and the at least one determined variable physiological parameter in an equation having the performance parameter and the variable physiological

20 parameter as variables therein.

5. The method of claim 2, further comprising steps of:

(b) repeating the step (a) during a first outing to obtain a first plurality of calculated

parameters, each of the first plurality of calculated parameters being calculated based upon a 25 respective determined foot contact time of the user and a corresponding heart rate of the user; and

(c) calculating an average value of the first plurality of calculated parameters.

6. The method of claim 5, wherein foot contact time and heart rate are the only

30 variables included in an equation used to calculate each of the first plurality of calculated parameters.

7. The method of claim 5, wherein each calculated parameter is proportional to a foot contact time of the user multiplied by a determined heart rate of the user.

8. The method of claim 5, wherein the step (a) includes a step of including the at least one determined performance parameter and the at least one determined variable physiological parameter in an equation having the performance parameter and the variable physiological parameter as variables therein.

9. The method of claim 5, further comprising steps of:

10 (d) repeating the step (a) during a second outing to obtain a second plurality of calculated parameters, each of the second plurality of calculated parameters being calculated based upon a respective determined foot contact time of the user and a corresponding heart rate of the user;

15 (e) calculating an average value of the second plurality of calculated parameters; and (f) comparing the average value of the second plurality of calculated parameters with the average value of the first plurality of calculated parameters to identify an increase or decrease in the user's fitness level.

10. The method of claim 1, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

11. The method of claim 2, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

25 12. The method of claim 1, wherein the at least one determined performance parameter of the user includes one of at least one determined speed of the user and at least one determined pace of the user, and the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

30 13. The method of claim 11, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

14. The method of claim 1, wherein the at least one determined performance parameter of the user includes at least one determined energy expenditure rate of the user, and the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

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15. The method of claim 14, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

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16. The method of claim 1, wherein the at least one determined performance parameter of the user includes at least one of at least one determined speed of the user, at least one determined pace of the user, at least one determined energy expenditure rate of the user, and at least one determined foot contact time of the user.

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17. The method of claim 1, wherein the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

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18. A method, comprising a step of:
(a) identifying at least one of an existence of a non-zero grade of a surface and a value of the grade of the surface based upon at least one determined variable physiological parameter of a user in locomotion on foot on the surface.

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19. The method of claim 18, wherein the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

20. The method of claim 19, wherein the step (a) includes a step of:
(a1) identifying the at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface based upon at least one determined foot contact time of the user corresponding to the at least one determined heart rate of the user.

21. The method of claim 20, wherein the step (a1) includes steps of:
determining a first parameter based upon a first determined foot contact time of the user
and a corresponding first heart rate of the user, the first parameter being determined at a first time
when the surface on which the user is in locomotion is level; and

5 determining a second parameter based upon a second determined foot contact time of the user
and a corresponding second heart rate of the user, the second parameter being determined at
a second time when the grade of the surface on which the user is in locomotion is unknown; and
comparing the second parameter with the first parameter to identify the at least one of the
existence of the non-zero grade of the surface and the value of the grade of the surface at the
10 second time.

22. The method of claim 21, wherein foot contact time and heart rate are the only
variables included in an equation used to calculate the first and second parameters.

15 23. The method of claim 21, wherein an equation used to calculate the first and
second parameters includes as a term therein the at least one determined foot contact time
multiplied by the at least one determined heart rate.

20 24. The method of claim 20, wherein the step (a1) includes steps of:
determining a first parameter by including a first determined foot contact time of the user
and a corresponding first heart rate of the user in a first equation having foot contact time and
heart rate as variables therein, the first parameter being determined at a first time when the
surface on which the user is in locomotion is level; and
calculating the value of the grade of the surface at the first time by including the first
25 parameter in a second equation defining a predetermined relationship between values of
parameters yielded by the first equation and grade values.

25. The method of claim 24, wherein foot contact time and heart rate are the only
variables included in the first equation.

26. The method of claim 24, wherein the first equation includes as a term therein the at least one determined foot contact time multiplied by the at least one determined heart rate.

27. The method of claim 18, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

28. The method of claim 19, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

10 29. A method, comprising a step of:

(a) identifying at least one of an existence of a grade of a surface and a value of the grade of the surface based upon at least one determined performance parameter of a user in locomotion on foot on the surface.

15 30. The method of claim 29, wherein the at least one determined performance parameter includes at least one determined foot contact time of the user.

31. The method of claim 29, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

20 32. The method of claim 30, wherein the step (a) is performed by at least one device supported by the user while the user is in locomotion on foot.

33. A system, comprising:

25 at least one processor configured to determine at least one calculated parameter based upon at least one determined performance parameter of the user and at least one determined variable physiological parameter of the user.

34. The system of claim 33, further comprising:

30 at least one first sensor that determines the performance parameter of the user while the user is in locomotion on foot; and

at least one second sensor that determines the variable physiological parameter of the user while the user is in locomotion on foot.

35. The system of claim 34, wherein:

5 the at least one first sensor determines foot contact times of the user while the user is in locomotion on foot; and

the at least one second sensor determines a heart rate of the user while the user is in locomotion on foot.

10 36. The system of claim 35, wherein the at least one first sensor does not require compression forces thereon to determine the foot contact times of the user.

15 37. The system of claim 35, wherein the at least one processor is configured such that foot contact time and heart rate are the only variables included in an equation used to determine the at least one calculated parameter.

20 38. The system of claim 35, wherein the at least one processor is further configured to determine the at least one calculated parameter such that the at least one calculated parameter is proportional to the at least one determined foot contact time multiplied by the at least one determined heart rate.

25 39. The system of claim 35, wherein the at least one processor is configured such that an equation used to determine the at least one calculated parameter includes as a term therein the at least one determined foot contact time multiplied by the at least one determined heart rate.

40. A system, comprising:

at least one processor configured to identify at least one of an existence of a non-zero grade of a surface and a value of the grade of the surface based upon at least one determined variable physiological parameter of a user in locomotion on foot on the surface.

41. The system of claim 40, wherein the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

42. The system of claim 41, further comprising at least one sensor that determines the
5 heart rate of the user while the user is in locomotion on foot.

43. The system of claim 41, wherein the at least one processor is further configured to identify the at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface based upon at least one determined foot contact time of the user
10 corresponding to the at least one determined heart rate of the user.

44. The system of claim 43, wherein the at least one processor is further configured to determine a first parameter based upon a first determined foot contact time of the user and a corresponding first heart rate of the user, the first parameter being determined at a first time when the surface on which the user is in locomotion is level, to determine a second parameter based upon a second determined foot contact time of the user and a corresponding second heart rate of the user, the second parameter being determined at a second time when the grade of the surface on which the user is in locomotion is unknown, and to compare the second parameter with the first parameter to identify the at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface at the second time.
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45. The system of claim 44, wherein the at least one processor is configured such that foot contact time and heart rate are the only variables included in an equation used to calculate the first and second parameters.

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46. The system of claim 44, wherein the at least one processor is configured such that an equation used to calculate the first and second parameters includes as a term therein the at least one determined foot contact time multiplied by the at least one determined heart rate.

30 47. The system of claim 41, wherein the at least one processor is further configured to determine a first parameter by including a first determined foot contact time of the user and a

corresponding first heart rate of the user in a first equation having foot contact time and heart rate as variables therein, the first parameter being determined at a first time when the surface on which the user is in locomotion is level, and to calculate the value of the grade at the first time by including the first parameter in a second equation defining a predetermined relationship between 5 values of parameters yielded by the first equation and grade values.

48. The system of claim 47, wherein the at least one processor is configured such that foot contact time and heart rate are the only variables included in the first equation.

10 49. The system of claim 47, wherein the at least one processor is configured such that the first equation includes as a term therein the at least one determined foot contact time multiplied by the at least one determined heart rate.

15 50. A system, comprising:

5 at least one processor configured to identify at least one of an existence of a non-zero grade of a surface and a value of the grade of the surface based upon at least one determined performance parameter of a user in locomotion on foot on the surface.

20 51. The system of claim 50, wherein the at least one determined performance parameter of the user includes at least one determined foot contact time of the user.

52. The system of claim 51, further comprising at least one sensor that determines foot contact times of the user while the user is in locomotion on foot.

25 53. The system of claim 52, wherein the at least one sensor does not require compression forces thereon to determine the foot contact times of the user.

54. A system, comprising:

30 at least one first sensor that determines at least one performance parameter of the user while the user is in locomotion on foot;

at least one second sensor that determines at least one variable physiological parameter of the user while the user is in locomotion on foot; and

means for determining at least one calculated parameter based upon the at least one determined performance parameter of the user and the at least one determined variable physiological parameter of the user.

5 55. The system of claim 54, wherein the at least one determined performance parameter of the user includes at least one determined foot contact time of the user.

10 56. The system of claim 55, wherein the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

15 57. The system of claim 54, wherein the at least one determined variable physiological parameter of the user includes at least one determined heart rate of the user.

58. The system of claim 55, wherein the at least one first sensor does not require compression forces thereon to determine the at least one foot contact time of the user.

20 59. A system, comprising:

at least one sensor that determines at least one physiological condition of a user while the user is in locomotion on foot on a surface; and

means for identifying at least one of an existence of a non-zero grade of the surface and a value of the grade of the surface based upon the at least one determined physiological condition of the user.

25 60. The system of claim 59, wherein the at least one sensor determines at least one heart rate of the user, and the means for identifying identifies the at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface based upon the at least one determined heart rate of the user.

61. A system, comprising:

at least one sensor that determines at least one performance parameter of a user while the user is in locomotion on foot on a surface; and

means for identifying at least one of an existence of a non-zero grade of the surface and a value of the grade of the surface based upon the at least one determined performance parameter of the user.

62. The system of claim 61, wherein:

the at least one sensor determines at least one foot contact time of the user while the user is in locomotion on foot; and

the means for identifying identifies the at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface based upon the at least one determined foot contact time of the user.

15 63. The system of claim 62, wherein the at least one sensor does not require compression forces thereon to determine the at least one foot contact time of the user.

64. A method, comprising steps of:

with at least one device supported by a user while the user is in locomotion on foot, determining at least one performance parameter of the user; and estimating a value of a variable physiological parameter of the user based upon the determined at least one performance parameter of the user.

25 65. The method of claim 64, wherein the at least one performance parameter of the user includes at least one foot contact time of the user.

66. The method of claim 65, wherein the variable physiological parameter of the user includes a heart rate of the user.

30 67. The method of claim 64, wherein the variable physiological parameter of the user includes a heart rate of the user.

68. A method, comprising steps of:

(a) identifying at least one of an existence of a non-zero grade of a surface and a value of the grade of the surface; and

5 (b) with at least one device supported by a user while the user is in locomotion on foot, determining at least one performance parameter of the user based upon the identified at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface.

69. The method of claim 68, wherein the at least one performance parameter includes

10 at least one of speed and pace.

70. A method, comprising steps of:

(a) determining at least one altitude of a user; and

(b) with at least one device supported by the user while the user is in locomotion on foot, 15 calculating at least one performance parameter of the user based upon the at least one determined altitude of the user.

71. The method of claim 70, wherein the step (a) includes a step of:

(a1) with an altimeter supported by the user, determining the at least one altitude of the

20 user.

72. The method of claim 71, wherein the at least one performance parameter includes at least one of speed, pace, and distance traveled.

25 73. The method of claim 70, wherein the at least one performance parameter includes at least one of speed, pace, and distance traveled.

74. A system, comprising:

at least one sensor, adapted to be supported by a user while the user is in locomotion on

30 foot, that determines at least one performance parameter of the user; and

at least one processor that calculates a value of a variable physiological parameter of the user based upon the determined at least one performance parameter of the user.

75. The system of claim 74, wherein the at least one performance parameter of the user includes at least one foot contact time of the user.

76. The system of claim 75, wherein the at least one variable physiological parameter of the user includes at least one heart rate of the user.

77. The system of claim 74, wherein the at least one variable physiological parameter of the user includes at least one heart rate of the user.

78. A system, comprising:

at least one processor, adapted to be supported by a user while the user is in locomotion on foot on a surface, that determines at least one performance parameter of the user based upon at least one of an identified existence of a non-zero grade of the surface and an identified value of the grade of the surface.

79. The system of claim 78, wherein the at least one performance parameter includes at least one of speed and pace.

80. A system, comprising:

at least one processor, adapted to be supported by a user while the user is in locomotion on foot, that calculates at least one performance parameter of the user based upon at least one identified altitude of the user.

81. The system of claim 80, further comprising an altimeter, adapted to be supported by the user while the user is in locomotion on foot, that determines the at least one altitude of the user.

82. The system of claim 81, wherein the at least one performance parameter includes at least one of speed, pace, and distance traveled.

5 83. The system of claim 80, wherein the at least one performance parameter includes at least one of speed, pace, and distance traveled.

84. A system, comprising:

at least one sensor, adapted to be supported by a user while the user is in locomotion on foot, that determines at least one performance parameter of the user; and

10 means for calculating a value of a variable physiological parameter of the user based upon the determined at least one performance parameter.

15 85. The system of claim 84, wherein the at least one performance parameter of the user includes at least one foot contact time of the user.

15 86. The system of claim 85, wherein the at least one variable physiological parameter of the user includes at least one heart rate of the user.

20 87. The system of claim 84, wherein the at least one variable physiological parameter of the user includes at least one heart rate of the user.

88. A system, comprising

means for identifying at least one of an existence of a non-zero grade of a surface and a value of the grade of the surface; and

25 means, adapted to be supported by a user while the user is in locomotion on foot, for determining at least one performance parameter of the user based upon the identified at least one of the existence of the non-zero grade of the surface and the value of the grade of the surface.

30 89. The system of claim 88, wherein the at least one performance parameter determined by the means for determining is at least one of speed and pace.

90. A system, comprising:

means for determining at least one altitude of a user; and

means, adapted to be supported by the user while the user is in locomotion on foot, for

calculating at least one performance parameter of the user based upon the at least one determined

5 altitude of the user.

91. The system of claim 90, wherein the at least one performance parameter calculated by the means for calculating includes at least one of speed, pace, and distance traveled.

故其子曰：「吾父之子，其名何也？」